UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

وزارة الصناعة والتجارة الخارجية

Solar Heating in Industrial Processes (SHIP) Project

The project "**Utilizing Solar Energy for Industrial Process Heat in Egyptian Industry**" is financed by the GEF and implemented by UNIDO in partnership with the Egypt National Cleaner Production Centre ENCPC. The objective of the project is to develop the market environment for the diffusion and local manufacturing of solar energy systems for industrial process heat. The project results will increase the knowledge and strengthen the awareness among the major stakeholders on the penetration potential of solar technologies in the food, chemical and textiles sectors in the region. The project focuses on improving the energy efficiency of the industrial process heating systems and the introduction of solar thermal technologies mainly in industrial companies that have low and medium temperature heat demand in three industrial sectors, namely the food, chemical and textiles sectors.

Mobica – Abou Rawash Plant Case Study

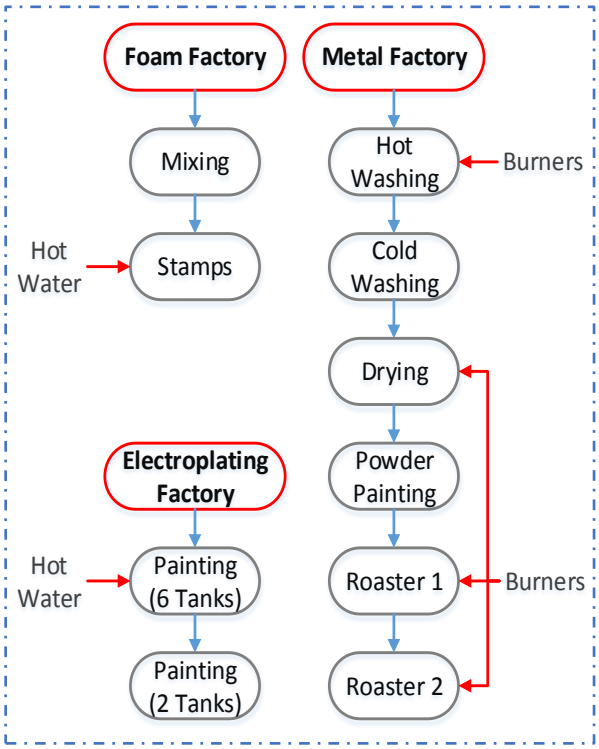
Abou Rawash, 6th October City, Giza, Egypt

Furniture Sector

Interior And Exterior Requirements

1,162,500 kWh/year electrical energy consumed

Production Processes Flow Diagram



Mobica is a family-owned private limited company. It was founded in 1979 in Egypt, and has since grown its purpose to supporting all interior and exterior requirements. The company now has 15 factories occupying an area of 280,000 m^2 covering a large scope including office, medical, educational furniture in addition to automotive supplies.

Abou Rawash plant includes many factories so the focus was limited to factories with thermal energy consumption which are Foam, Electroplating and Metal factories. The three factories processes flow diagram exhibits the main processes performed and the their thermal requirement. Based on the available data, general analysis on the energy consumption indicates that the **heating load** for Foam and Electroplating factories represent **66.5%** and **17.5%** of the **total electrical** energy consumption.

Thermal energy system is supplied by **direct burners** using **natural gas**. Also hot water is supplied by **six hot water boilers**, two boilers each of 1 m^3 and four boilers each of 0.75 m^3 capacity. Each boiler is **electrically-heated** using coils. If the suggested optimization measures were applied, unnecessary losses will be eliminated and can operate the system at much lower cost.

- Optimization Opportunities -

Thermal Insulation

Process Optimization

Waste Heat Utilization

Solar Water Heating

Insulation of Hot Water Pipes

Thermal insulation is a general principle that should be applied in all hot surfaces in the factories. **The proposed solution** is to **insulate** e piping system of the foam factory. The collective saving from proper insulation is usually enormous. This solution will help **to reduce energy consumption** (save about **5%** of the total heat load), **CO_2 emissions**, and **operation costs**. **Safety will be enhanced** after **reducing** surface temperature.

Capex: 1,810 **USD/meter**
Energy Savings: 17,015 **kWh/year**
Payback: 1.4 **years**
CO_2 Reduction: 8.5 **tCO_2/year**

Stop Heating Triple Chrome Tank In Summer

In Electroplating factory, the triple chrome tank can normally operate at ambient conditions during summer. Despite that, it is currently heated with the other tanks in both summer and winter. The **proposed solution** is to **stop heating this tank** during summer. This solution will help to **reduce energy consumption** (save about **6%** of the total heat load), **CO_2 emissions**, and **operation costs** with **no capital cost**.

Capex: no/low cost
Energy Savings: 1,730 **kWh/year**
Payback: immediately
CO_2 Reduction: 0.86 **tCO_2/year**

Partially Stop Heating One of The Polished Nickel Tanks

It was noticed that all the work pieces are immersed in first nickel tank (unpolished nickel), then divided between the two polished nickel tanks. The two polished nickel tanks have the same characteristics and the same temperature profile. **The proposed solution** is to **heat only one tank** of them and use it for all pieces whenever possible. This solution will help to **reduce energy** consumed with **no capital cost**.

Capex: no/low cost
Energy Savings: 5,280 **kWh/year**
Payback: immediately
CO_2 Reduction: 2.6 **tCO_2/year**

Integration of Solar Thermal Heating System

Solar heating technologies collect thermal energy from the sun and this heat can be used for heating purposes. Solar collectors are selected based on the range of the operating temperature range and the type of the industrial sector. Heat in the lower temperature range (<100 °C) can easily be provided with systems commercially available, such as flat plate collectors (FPC) and evacuated tube collectors (ETC). The **scenario envisioned** for both of Foam and Electroplating factories is to **partially/totally heat the required water** which will decrease the energy consumed. For Electroplating factory, the system will occupy **165 m^2** of area and is designed to **heat 10 m^3/day** to **90 °C** to save **energy** of about **78,740 kWh/year**. The **system cost** is around **USD 61,150** and the **annual savings** will be **USD 6,150** with **payback** period of **10 years**. The parameters of the foam factory system are shown below;

270 m^2 using FPC
System Design Area

204,110 kWh/year
Energy Savings

64,440 USD
Capex

USD 15,950
Annual Savings

4 years
Payback

102 tCO_2/year
CO_2 Reduction

15 m^3/day
Water Flow Rate

70 °C
Design Temperature

20 Years
Lifetime

Lessons Learnt

- **Thermal insulation is a quick win. It saves energy with very low upfront costs and have high impact and low payback.**
- **Process optimization requires low cost and efforts and has high impact on energy consumption and CO_2 emissions reduction.**
- **Solar thermal integration combines renewable energy resources utilization and energy savings measures.**
- **Combining Solar thermal integration with energy efficiency measures improves system design and feasibility.**

The **total proposed solutions** summary:

- **Thermal Energy Savings:** up to **309,875 kWh/year**, representing about **26.7%** savings of the total energy consumption (where **24.3%** is due to the integration of SWH systems),
- **Financial Savings: 24,210 USD/year,**
- **Capital Cost**: **~130,035 USD**,
- **Overall Payback Period: 5.4 years**,
- **CO_2 Emissions Reduction: 155 tCO_2eq/year**.

SCAN ME

SOLAR Heating for Industrial Process
Together Toward Efficient Production

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